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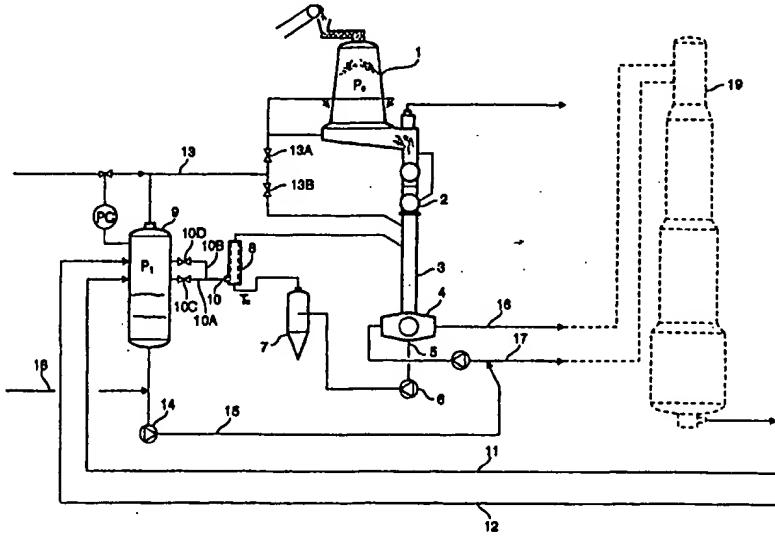
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## Published

*With international search report.  
With amended claims.*

(54) Title: **METHOD IN CONNECTION WITH THE PRETREATMENT OF COMMINUTED FIBROUS MATERIAL**

## (57) Abstract

A method in connection with the pretreatment of comminuted fibrous material intended for chemical cellulose pulp production, wherein said comminuted fibrous material is fed through a low pressure system comprising a gas phase part followed by a liquid phase part, said liquid phase part including a low pressure circulation where a circulating liquid is withdrawn from said fibrous material and is recirculated back to said fibrous material in an upstream position, said fibrous material is sluiced (4) into a high pressure system comprising a liquid phase transfer part operatively connected to a digester (19). Hot process liquid (11, 12) and/or said circulating liquid (10) is evaporatively cooled by being allowed to flash within said low pressure system.

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Title: Method in connection with the pretreatment of  
comminuted fibrous material

**DESCRIPTION**

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Technical field:

The present invention relates to a method in connection with the pretreatment, that is steaming and impregnation, of comminuted fibrous material that is 10 intended for use in cellulose production by chemical methods, for example kraft cellulose production.

State of the art and problems:

In the production of cellulose pulp from 15 comminuted fibrous material, preferably wood chips, by chemical methods, for example kraft cooking, there is a need to pretreat the material before the cooking in order to drive out gas and vapour from the cavities inside the wood chips and replace it with a liquid at the same time 20 as the chips are heated.

Conventional pretreatment processes normally include a chip bin from which the chips are fed via a low pressure feeder to low pressure system which comprises a steaming vessel followed by a chip chute. At the lower 25 end of the chip chute there is optionally arranged a pump and thereafter a pressure sluice, a so called high pressure feeder, by aid of which the chips are introduced into a high pressure system. From the high pressure feeder there is also an outgoing line that establishes a 30 liquid phase low pressure circulation together with a pump, a sand trap, a tubular strainer and a level tank. By this low pressure circulation, circulating liquid is transferred back to the fibrous material in an upstream position. The high pressure system includes a transfer 35 circulation that transfers the chips, together with

liquor, to the top of a digester or an impregnation vessel. A part of the liquor is separated from the chips at the top of the digester and transferred back to the high pressure feeder. The chips are cooked in the 5 digester in an upper concurrent zone followed by a lower countercurrent zone. An extraction screen section is arranged between these zones. Hot black liquor is extracted from this screen section and led to a flash tank, which is usually coupled in series with a second 10 flash tank. The steam phase from the flash tanks is usually used as a direct heat source in said chip bin and/or steaming vessel. There is a need to cool (by means of cold white liquor or separate cooling with cold water) the liquor in the return line of the transfer circulation 15 and/or the circulating liquid in the low pressure circulation in order to avoid flashing and resulting bangs in the high pressure feeder.

From US 5,053,108 there is known a process where black liquor is led to the chip chute. This black liquor 20 originates from the flash tanks and has hence been cooled through the pressure release in the flash tanks.

In a conventional system there is a potential to enhance the heat economy to an extent which has not been fully done in the past.

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#### Solutions and advantages:

The object of the present invention is to provide an improved method in connection with the pretreatment of comminuted fibrous material, which method provides a way 30 to avoid bangs in the high pressure feeder and also gives better heat economy and less equipment than conventional methods.

This is achieved by the method according to patent claim 1, which means that hot process liquid 35 and/or circulating liquid in the low pressure circulation

is evaporatively cooled by being allowed to flash within said low pressure system. Said hot process liquid is preferably uncooled before its entry into the low pressure system. The pressure of said hot process liquid 5 is preferably essentially the same as in the high pressure system.

Normally, said low pressure system includes a low pressure circulation where liquid is withdrawn from said fibrous material and is recirculated back to said fibrous 10 material in an upstream position. The conventional low pressure circulation comprises a level tank for pressure balancing against a gas phase part of the low pressure system, so that a liquor level (normally in the chip chute) between said gas phase part and said liquid phase 15 part can be controlled and a liquid flow from said low pressure circulation can be stabilised. Said level tank is in the following included in the low pressure system and in the low pressure circulation, although the liquid which is formed in the bottom of the tank is normally 20 withdrawn from the circulation and also although the saturation pressure at the temperature in the level tank may be lower than in the rest of the low pressure system. According to a further aspect of the invention said hot 25 process liquid and/or said circulating liquid is allowed to flash into said level tank.

A further aspect of the invention is that steam is produced by said flashing and that this steam is used for direct heating of said fibrous material.

A further aspect of the invention is that said 30 hot process liquid comprises black liquor.

Yet a further aspect of the invention is that said hot process liquid has a temperature of 100-180°C, preferably 110-170°C and more preferably 120-160°C and a pressure of 3 - 25 bar, preferably 4 - 20 bar and more 35 preferably 5 - 15 bar.

According to a further aspect of the invention, the pressure in said low pressure system is 0,5 - 5 bar (abs), preferably 0,7 - 4 bar and more preferably 1 - 3 bar and the temperature is 60-145°C, preferably 80-130°C  
5 and more preferably 90-120°C.

Yet a further aspect of the invention is that a liquid phase is formed in said level tank, which liquid is conveyed to said transfer circulation of the high pressure system in order to be further conveyed to the  
10 digester.

Another advantage of the method is that flashing with resulting bangs in the high pressure feeder can be avoided without the need of energy degrading cooling by cold water.

15 An advantage of the method according to the invention is that the live steam consumption can be reduced which results in an improved heat economy.

Another advantage is increased dryness of spent black liquor.

20 Another advantage is that less equipment is needed when performing the same process as in conventional systems.

#### Detailed description:

25 The invention will be explained in greater detail hereinafter with reference to the drawing which is a diagrammatic representation of a preferred flow sheet for continuous pretreatment of fibrous material in accordance with the present invention.

30 In the drawing, the reference number (1) denotes a chip bin which may be atmospheric or operating at a minor overpressure. The wood chips are fed into the top of the chip bin and are treated therein in a gas phase with steam in order to heat the chips and to drive out  
35 gas from their internal cavities. After this treatment

the chips are fed via a low pressure feeder (2) to a low pressure system which optionally comprises a steaming vessel (not shown) followed by a chip chute (3). In the chip chute the chips leave the gas phase part and enters 5 a liquid phase part of the system. At the lower end of the chip chute there is arranged a pressure sluice, a so called high pressure feeder (4), by aid of which the chips are introduced into a high pressure system. From the high pressure feeder (4) there is also an outgoing 10 line (5) that establishes a liquid phase low pressure circulation together with a pump (6), a sand trap (7), a tubular strainer which hereinafter is called an inline drainer (8) and a level tank (9). The low pressure liquor in line (5) is fed by the pump (6) into the sand trap 15 (7), where sand is separated from the liquor, and further through the inline drainer (8) back into the chip chute (3). From the inline drainer there is also an outgoing line (10, 10B) via a valve (10D) to the level tank (9). The object of the level tank is conventionally only to 20 act as a pressure balancing apparatus against said gas phase part of the low pressure system, so that a liquor level between said gas phase part and said liquid phase part can be controlled and a liquid flow from said low pressure circulation can be stabilised. In the present 25 invention, the level tank however also acts as a flash tank. Hot, preferably uncooled, process liquid (11, 12), which may comprise black liquor, from the high pressure system is led into the level tank, above a liquor level. As a result of the released pressure, the liquid flashes 30 into steam and a colder liquid. The steam is, according to the invention, led in a line (13), optionally together with live low pressure steam, through a valve (13A), to the chip bin (1), where it is used for direct heating of the wood chips. Liquid from the level tank (9) is pumped 35 (14) together with an incoming cold process liquid (18),

which preferably consists of white liquor, to the high pressure system. The high pressure system includes a transfer circulation with a feed line (16), that transfers the chips, together with liquor, to the top of 5 a digester (19). A part of the liquor is separated from the chips at the top of the digester and transferred back to the high pressure feeder through a return line (17). The chips are cooked in the digester in an upper concurrent zone followed by a lower countercurrent zone. 10 An extraction screen section (not shown) is arranged between these zones. Hot black liquor is extracted from this screen section.

In the above described, first embodiment of the invention, the saturation pressure  $P_9$  at the temperature 15 in the level tank is approximately the same as the pressure  $P_1$  in the chip bin. The saturation pressure  $P_{11}$  (and  $P_{12}$ ) at the temperature of the hot process liquid (11, 12) is, however substantially higher than  $P_1$  and  $P_9$ . For this reason, the hot process liquid flashes into 20 the level tank (9). The saturation pressure  $P_8$  at the temperature in the inline drainer is also higher than  $P_9$ , which results in a flashing and cooling also of the liquid that is led into the level tank via the line (10B) that mouths above the liquid level in the level 25 tank.

In a second embodiment, which does not include flashing of the hot process liquid, it is merely the liquid from the inline drainer (8) that is led into the level tank via the line (10B) that mouths above the 30 liquid level in the level tank. This embodiment provides a beneficial way to cool the liquid within the low pressure circulation.

In a third embodiment, the steam from the level tank is led in line (13), through a valve (13B), into the 35 chip chute (3). In this case, there is not an open

connection between the level tank and the chip bin and hence  $P_9$  is higher than  $P_1$  but still lower than  $P_{11}$  ( $P_{12}$ ).  $P_8$  is, however, approximately the same as  $P_9$  and the liquid from the inline drainer is thus led in a line (10, 5 10A) through a valve (10C) into the level tank (9) under the liquid level. No flashing of the liquid from the inline drainer takes place.

The two different embodiments can suitably be implemented in a manner so that either alternative can be 10 operated in the same mill. If the first or second mentioned embodiments are wished, the valves (13A) and (10D) are open and (13B) and (10D) are closed. If the third embodiment is wished, the valves (13B) and (10D) are open and (13A) and (10D) are closed.

15 The invention is not delimited by the above mentioned description and embodiments, but can be varied within the scope of the claims. The skilled man will for instance realise that the same effect can be achieved by flashing into another vessel within the low pressure 20 system. Also, the steam from the flashing can be led to condensers instead of the chip bin. Moreover, the combination of the possibilities to open or shut the valves are numerous. Although the drawing shows a certain type of equipment in the low and high pressure systems, 25 it is of course possible to implement the invention in both older and newer systems. There can, for instance, be an impregnation vessel before the digester, in which case the chips are transferred from the high pressure feeder to the impregnation vessel and subsequently to the 30 digester.

## Patent Claims

1. A method in connection with the pretreatment of comminuted fibrous material intended for chemical cellulose pulp production, wherein said comminuted fibrous material is fed through a low pressure system comprising a gas phase part followed by a liquid phase part, said liquid phase part including a low pressure circulation where a circulating liquid is withdrawn from said fibrous material and is recirculated back to said fibrous material in an upstream position, said fibrous material is sluiced (4) into a high pressure system comprising a liquid phase transfer part operatively connected to a digester (19),  
15 characterised in that hot process liquid (11, 12), from said high pressure system, and/or said circulating liquid (10) is evaporatively cooled by being allowed to flash within said low pressure system.
- 20 2. The method as claimed in patent claim 1, wherein said low pressure circulation comprises a level tank (9) for pressure balancing against said gas phase part of the low pressure system, so that a liquor level between said gas phase part and said liquid phase part 25 can be controlled and a liquid flow (15) from said low pressure circulation can be stabilised, characterised in that said hot process liquid (11, 12) and/or said circulating liquid (10) is allowed to flash into said level tank (9).
- 30 3. The method as claimed in patent claim 1 or 2, characterised in that steam is produced by said flashing and that it is used for direct heating of said fibrous material.

4. The method as claimed in any one of the preceding patent claims,  
characterised in that said circulating liquid (10), that is flashed, originates from an inline  
5 drainer (8).

5. The method as claimed in any one of the preceding patent claims,  
characterised in that said hot process  
10 liquid (11, 12) comprises black liquor.

6. The method as claimed in any one of the preceding patent claims,  
characterised in that said hot process  
15 liquid (11, 12) has a temperature of 100-180°C,  
preferably 110-170°C and more preferably 120-160°C.

7. The method as claimed in any one of the preceding patent claims,  
20 characterised in that the pressure of said hot process liquid (11, 12) is 3 - 25 bar, preferably 4 -  
20 bar and more preferably 5 - 15 bar.

8. The method as claimed in any one of the preceding  
25 patent claims,  
characterised in that the pressure in said low pressure system is 0,5 - 5 bar(abs), preferably 0,7 -  
4 bar and more preferably 1 - 3 bar.

30 9. The method as claimed in any one of the preceding patent claims,  
characterised in that the temperature in said low pressure system is 60-145°C, preferably 80-130°C  
and more preferably 90-120°C.

10. The method as claimed patent claim 2,  
characterised in that a liquid phase is  
formed in said level tank (9), which liquid is conveyed  
(14, 15) to said transfer part (16, 17) of the high  
5 pressure system in order to be further conveyed to the  
digester.

## AMENDED CLAIMS

[received by the International Bureau on 18 March 1998 (18.03.98);  
original claim 1 amended; remaining claims unchanged (2 pages)]

1. A method in connection with the pretreatment of comminuted fibrous material intended for chemical cellulose pulp production, wherein said comminuted fibrous material is fed through a low pressure system comprising a gas phase part followed by a liquid phase part, said liquid phase part including a low pressure circulation where a circulating liquid is withdrawn from said fibrous material and is recirculated back to said fibrous material in an upstream position, said fibrous material is sluiced (4) into a high pressure system comprising a liquid phase transfer part operatively connected to a digester (19),  
15 characterised in that hot process liquid (11, 12), from said high pressure system, is evaporatively cooled by being allowed to flash within said low pressure system.
- 20 2. The method as claimed in patent claim 1, wherein said low pressure circulation comprises a level tank (9) for pressure balancing against said gas phase part of the low pressure system, so that a liquor level between said gas phase part and said liquid phase part 25 can be controlled and a liquid flow (15) from said low pressure circulation can be stabilised, characterised in that said hot process liquid (11, 12) and/or said circulating liquid (10) is allowed to flash into said level tank (9).
- 30 3. The method as claimed in patent claim 1 or 2, characterised in that steam is produced by said flashing and that it is used for direct heating of said fibrous material.

4. The method as claimed in any one of the preceding patent claims,  
characterised in that said circulating liquid (10), that is flashed, originates from an inline  
5 drainer (8).

5. The method as claimed in any one of the preceding patent claims,  
characterised in that said hot process  
10 liquid (11, 12) comprises black liquor.

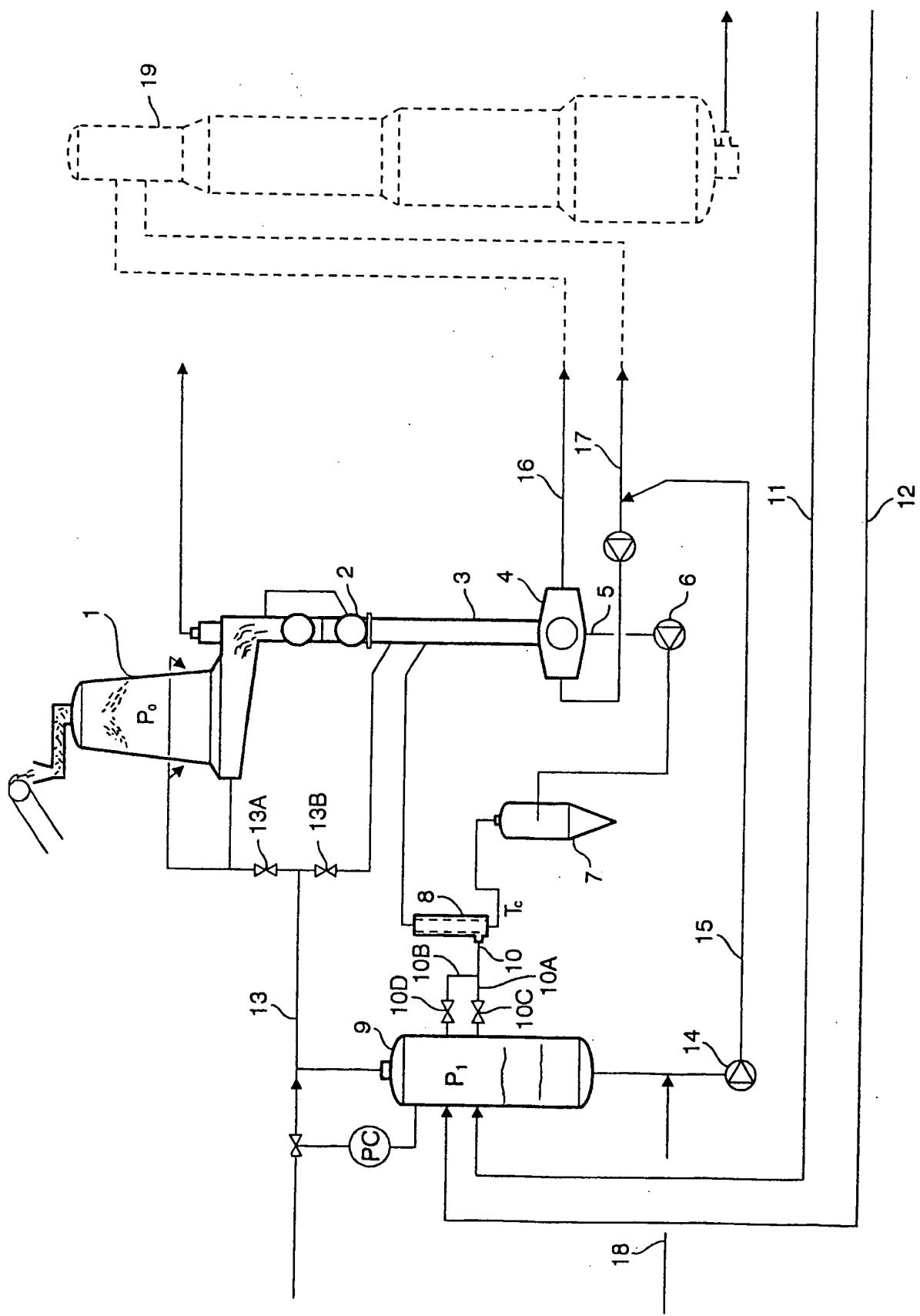
6. The method as claimed in any one of the preceding patent claims,  
characterised in that said hot process  
15 liquid (11, 12) has a temperature of 100-180°C,  
preferably 110-170°C and more preferably 120-160°C.

7. The method as claimed in any one of the preceding patent claims,  
20 characterised in that the pressure of said hot process liquid (11, 12) is 3 - 25 bar, preferably 4 -  
20 bar and more preferably 5 - 15 bar.

8. The method as claimed in any one of the preceding  
25 patent claims,  
characterised in that the pressure in said low pressure system is 0,5 - 5 bar(abs), preferably 0,7 -  
4 bar and more preferably 1 - 3 bar.

30 9. The method as claimed in any one of the preceding patent claims,  
characterised in that the temperature in said low pressure system is 60-145°C, preferably 80-130°C  
and more preferably 90-120°C.

Fig. 1



SUBSTITUTE SHEET (RULE 26)

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 97/01135

## A. CLASSIFICATION OF SUBJECT MATTER

IPC6: D21C 3/24, D21C 7/06

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: D21C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE, DK, FI, NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

PATFULL

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 9534712 A1 (KAMYR, INC.), 21 December 1995 (21.12.95), page 3, line 13 - line 19; page 5, line 7 - line 13; page 6, line 29 - line 30, page 12, line 4 - line 17; page 13, line 5 - line 15, figure 5,8	1-3,8-9
Y	---	1-10
Y	WO 9703243 A1 (KVAERNER PULPING AB), 30 January 1997 (30.01.97), page 5, line 1 - line 3; page 5, line 17 - line 22; page 6, line 31 - line 35, figure 1	1-10
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 Further documents are listed in the continuation of Box C. See patent family annex.

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**INTERNATIONAL SEARCH REPORT**  
Information on patent family members

07/01/98

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Patent document cited in search report	Publication date	Patent family member(s)		Publication date
WO 9534712 A1	21/12/95	AU 2606295 A		05/01/96
		CA 2191207 A		21/12/95
		FI 964971 A		14/02/97
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WO 9703243 A1	30/01/97	SE 504644 C		24/03/97
		SE 9502573 A		13/01/97